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TRANSACTION COSTS OF RURAL BANK BRANCHES IN BANGLADESH

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ABSTRACT

A system of cost equations is estimated for rural bank branches in Bangladesh in order to evaluate the overall costs of financial intermediation and related cost concepts. Costs of intermediation are well above authorized spreads. The average bank branch displayed constant returns to scale.

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Introduction

The literature on rural finance in developing countries has been dominated during the past couple of decades by a preoccupation with extending loans to farmers. Relatively little attention has been given to the costs of financial intermediation and to bank efficiency. Any concern shown for efficiency has focused only on financial costs. It has been assumed that the nonfinancial costs were negligible. Recent research in Honduras, Jamaica, and the Philippines appears to challenge this assumption (e.g., Cuevas, Lamberte, Nyanin). These studies suggest that resource costs of financial intermediation are significant, and the viability of many institutions may be threatened if these costs are not covered.

There is little evidence of concern in Bangladesh, for costs and efficiency in banking. Studies by the World Bank in the early 1980s speculated on the magnitude of administrative costs. One study estimated that 63 percent of the rural bank branches in Bangladesh were non-viable i.e., the banks were unable to recover the minimum administrative costs of operating a typical rural bank branch.

Further, in Bangladesh, as in numerous other low-income countries, financial policies have been actively used as instruments for economic development. The set of policies include ceilings on interest rates, branch and bank licensing restrictions, and credit-allocation policies. Benston and Smith, in their study of the impacts of regulation on costs of U.S. banks, conclude that "government regulation increases the transactions costs of financial intermediation principally by restricting financial intermediaries from operating as efficiently as they otherwise would" (p.228). Since

regulatory policies in low-income countries are more pervasive, it is expected that similar conclusions hold. Cuevas' study found strong evidence of the cost-increasing effect of regulation in Honduras.

This paper attempts to measure the cost-output relationship and production technology of a major nationalized commercial bank in the regulatory environment prevalent in Bangladesh. The financial system is viewed as a service sector, and the role of transaction costs in the provision of financial services is emphasized. More specifically, the effects of branching policies on the size and product-mix of bank branches will be examined. The remainder of this paper describes the model, data, and empirical results. The paper concludes with a brief summary of the major findings.

I. The Model

Nationalized bank branches are assumed to minimize the costs associated with a given level of output. Solving the bank's cost minimization problem yields the cost function,

$$C = F(Q, P) \tag{1}$$

where $Q(=q_1,.....,q_m)$ is an m-dimensional vector of bank output levels, and $P(=p_1,....,p_n)$ is an n-dimensional vector of input prices (Varian). Bank branches are assumed to treat input prices and output quantities as exogenous elements in the decision process.

The functional form, F, was assumed to be of the translog variety. The advantages are that the translog is a flexible functional form, and is well-suited to the analysis of the cost properties of multiproduct firms such as economies of scale and scope (Caves and Christensen). The translog function

is quadratic in the logarithm of output quantities and input prices, and linear in the parameters. The general form can be written as follows,

$$\ln C = \alpha_0 + \sum_{i=1}^{m} \alpha_i \ln q_i + \sum_{j=1}^{n} \beta_j \ln p_j + 1/2 \sum_{i=1}^{m} \sum_{k=1}^{m} \gamma_{ik} \ln q_i \ln q_k$$

$$+ 1/2 \sum_{j=1}^{n} \sum_{s=1}^{n} \lambda_{js} \ln p_j \ln p_s + \sum_{i=1}^{m} \sum_{j=1}^{n} \theta_{ij} \ln q_i \ln p_j \qquad (2)$$

where, q_i is the quantity of the ith output, p_j is the price of the jth input, and ln denotes natural logarithm. Neo-classical theory suggests that (2) is linearly homogenous in all input prices, concave in p_j, and increasing in q_i and p_j (Varian). It is possible to derive a system of cost-share equations directly from the translog cost function by differentiating (2) with respect to p_j,

$$M_j = \frac{p_j x_j}{C} = \frac{\partial \ln C}{\partial \ln p_j}$$

$$\text{or} \quad M_j = \beta_j + \sum_{s=1}^{n} \lambda_{js} \ln p_s + \sum_{i=1}^{m} \theta_{ij} \ln q_i \qquad (3)$$

where M_j is the cost share of the jth input (Shephard's lemma). Symmetry conditions and linear homogeneity restrictions are imposed for estimation. The latter are exactly the same parametric restrictions imposed by the requirement that the sum of the cost shares (3) must equal one (Caves, Christensen, and Tretheway).

Along the lines of earlier cost studies, several economically important properties can be derived from the cost function (2). These properties are summarized below (Benston et al., Gilligan et al., Murray and White).

Economies of Scale

The overall economies of scale realized in the general case when all outputs are increased by a common factor, δ, is obtained by differentiating (2) with respect to all q_i,

$$S = \sum_{i=1}^{m} \frac{\partial \ln C}{\partial \ln q_i}$$

$$\text{or} \quad S = \sum_{i=1}^{m} \alpha_i + \sum_{i=1}^{m} \sum_{k=1}^{m} \gamma_{ik} \ln q_k + \sum_{i=1}^{m} \sum_{j=1}^{n} \theta_{ij} \ln p_j \tag{4}$$

It is evident from (4) that overall scale economies are a function of differences in output mix as well as differences in factor prices. If S is less than one, there are economies of scale, since costs increase proportionately less than output. Values of S equal to or greater than one correspond to constant returns or diseconomies, respectively.

In addition, the translog form also permits evaluation of the effects of variations in the output of one product, holding constant the quantities of other products. Product-specific economies of scale, S_i, are defined as the marginal cost of producing a particular product divided by the average incremental cost of its production,

$$S_i = \frac{\partial C / \partial q_i}{(C(Q) - C(Q_{-i}))/q_i} \tag{5}$$

where, Q_{-i} is the output vector with a zero replacing the quantity of the ith output. If S_i is less than one, then product-specific scale economies exist.

Interproduct Cost Complementarities

Economies of scope exist if the bank can produce a group of products in combination more cheaply than it can produce the same group of products individually (Panzar and Willig). Interproduct cost complementarities is a weaker concept and exists if the marginal cost of producing one product declines with increases in production of another product. Cost complementarities exist between q_i and q_k if,

$$\frac{\partial^2 C}{\partial q_i \partial q_k} < 0 \qquad (6)$$

An approximate condition for cost complementarity, suggested by Murray and White, in terms of the parameters of the translog cost function is,

$$\gamma_{ik} + \alpha_i \alpha_k < 0 \qquad (7)$$

II. The Data

The estimation of the cost function reported in this paper used semi-annual income-expense statements obtained for a period of two years (1983 and 1984) from 40 branches of Agrani Bank, one of the largest commercial banks in Bangladesh. All of the sample branches are located in rural areas. Quarterly data on number and amount of loans and deposits were obtained from the central bank of the country. All variables have been expressed in real terms (takas of 1973/74) using the rural consumer price index. Variable definitions are briefly outlined below:

(a) Total costs, C, include all operating/administrative expenses net of depreciation and bad debt reserves.

(b) Following Cuevas, two alternative definitions of bank output were used: (i) the number of loan and deposit accounts (as separate outputs), and (ii) the value of deposit and loan balances outstanding.

(c) Two input categories have been defined: labor and capital. The unit cost of labor is defined as total personnel costs including benefits divided by the total number of employees. The unit price of capital was obtained by summing the major capital expenses such as rent and depreciation, and dividing by the value of deposit and loan balances outstanding at the end of the period.

(d) Loan and deposit sizes were included in the model to account for the heterogeneity of loan and deposit transactions. They are included in the cost function (2) in interactive form with the output levels. In this way, the cost concepts become dependent on the average size of loans and deposits.

Since the sum of the cost shares by definition must equal unity, one of the equations in (3) is redundant and, therefore, is dropped from the system. Fortunately, maximum likelihood estimates should be invariant to the equation excluded (Johnston). The estimating form of the model consists of equation (2) and the labor-share equation. An iterative Zellner procedure is used on the cost system, allowing for nonzero correlations in the off-diagonal elements of the disturbance covariance matrix.

III. Results

Parameter estimates are reported in Table 1 for the cost system using both definitions of output. The system R^2 was .53 (model 1) and .33 (model 2). Most of the estimates are statistically significant and carry the

expected signs, despite the large number of variables included in the regression. There is statistical support for a cost function that is regular and the factor-price homogeneity restrictions were significant in both models. The size variables exerted a positive influence on costs in model 1 and a negative influence in model 2. This difference will be discussed below. The residuals were tested for normality, homoscedasticity, and independence. The null hypotheses could not be rejected in all cases.

The results in Table 2 apply to an average bank branch which produces the geometric mean output vector, and pays the geometric mean prices for factors of production. This is the point of local approximation. Rows 1 and 2 of Table 2 indicate the distribution of total intermediation costs in the bank between lending costs and costs of deposit mobilization.[1] Rows 3 through 8 show the average and marginal costs of lending and deposit-mobilization, and overall intermediation costs on a per taka[2] and per account basis. Over 60 percent of the bank's costs of intermediation correspond to deposit mobilization activities, whereas only 29-34 percent of its costs are attributed to lending. This finding appears to reflect a greater reliance of the branches on deposits mobilized from various sources rather than intra-bank borrowing. However, the underlying pattern in the composition of the bank's liabilities is not completely reflected in the participation of lending and deposit mobilization activities in total intermediation costs. This issue is discussed in greater length below.

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1. The exercise in cost allocation between outputs follows the analysis of Laitinen.
2. Taka is a unit of Bangladesh currency, where Tk.25 ≈ $1.00 during the study period. Figures in takas are takas of 1973/74.

Table 1. Agrani Bank: Estimated Parameters of the Cost Function. System Estimation with Two Output Definitions[a/]

Parameter (Variable)[b/]	Model (Output Definition) (1) Value of Deposits and Loan Balances: Estimate	(1) t-ratio (asymptotic)	(2) Number of Deposit and Loan Accounts: Estimate	(2) t-ratio (asymptotic)
α_0 (Intercept)	1.830	1.251	2.3244	1.215
α_1 ($\ln q_1$)	0.0250	0.077	0.3871	0.884
α_2 ($\ln q_2$)	0.7174	4.852*	0.3865	1.973**
β_1 ($\ln p_1$)	0.5961	5.440*	0.4580	3.246*
β_2 ($\ln p_2$)	0.4039	3.687*	0.5420	3.841*
γ_{11} $(\ln q_1)^2$	0.2599	5.754*	0.1123	1.628
γ_{22} $(\ln q_2)^2$	0.0620	4.377*	0.1035	5.036*
γ_{12} ($\ln q_1 \ln q_2$)	-0.1172	-5.615*	-0.0704	-2.574**
λ_{11} $(\ln p_1)^2$	0.0119	0.789	0.0219	1.721†
λ_{22} $(\ln p_2)^2$	0.0119	0.789	0.0219	1.721†
λ_{12} ($\ln p_1 \ln p_2$)	-0.0119	-0.789	-0.0219	-1.721†
θ_{11} ($\ln q_1 \ln p_1$)	-0.0402	-3.153*	-0.0188	-1.016
θ_{12} ($\ln q_1 \ln p_2$)	0.0402	3.153*	0.0188	1.016
θ_{21} ($\ln q_2 \ln p_1$)	-0.0040	-0.431	-0.0183	-2.436**
θ_{22} ($\ln q_2 \ln p_2$)	0.0040	0.431	0.0183	2.436**
η_1 ($\ln q_1 \ln DS$)	-0.0057	-0.463	0.0590	5.897*
η_2 ($\ln q_2 \ln LS$)	-0.0112	-2.172**	0.0377	4.814*
R^2	0.53		0.33	

a/ Factor-price homogeneity and cross-equation restrictions imposed on estimation. N=160. Levels of significance: *=0.01; **=0.05; †=0.10.
b/ Variable definitions are: q_1 is deposits; q_2, loans; p_1, price of labor; p_2, price of capital; DS, deposit-size; LS, loan-size.

Table 2. Lender's Intermediation Costs: Lending Costs and Related Cost Concepts. Summary of Findings for Agrani Bank with Two Output Definitions.

Cost Concept	Model (Output Definition) (1) Value of Deposit and Loan Balances	(2) Number of Loan and Deposit Accounts
1. Share of Deposit-Mobilization Costs in Total Intermediation Costs	70.6%	65.7%
2. Share of Lending Costs in Total Intermediation Costs	29.4%	34.3%
Costs of Lending		
3. Average Costs	2.88%	4.80%
4. Marginal Costs	0.80%	1.48%
Costs of Mobilizing Deposits		
5. Average Costs	4.22%	1.86%
6. Marginal Costs	2.80%	1.10%
Overall Intermediation Costs		
7. Average Costs	7.10%	6.66%
8. Marginal Costs	3.60%	2.58%
9. Economies of scale (S)	0.94	0.90
F-test for H_0: S = 1	(1.35)	(1.82)
Partial Economies of Scale (S_i)		
10. S_1, Deposits	0.66	0.59
11. S_2, Loans	0.28	0.31
12. Cost Complementarities	-0.099	0.079
F-test for H_0: $\gamma_{12}+\alpha_1\alpha_2=0$	(0.19)	(0.19)

Source: Results of cost-system estimations, Table 1, evaluated at the geometric means of the variables in the models.

Although the overall costs of financial intermediation are not significantly different in the two models, costs of lending and deposit mobilization show a contrast in the two output definitions. The estimated average cost per loan is more than twice as high as the average cost per deposit account (model 2). However, the average size of loan made by the bank was almost 3 times that of the average deposit size during the sample period. In part, this helps explain the difference in average costs per taka lent and mobilized as deposits (model 1).

It is important to note that the cost estimates reported in Table 2 do not include provisions for bad debt; thus they represent a lower bound for the operational spread required, assuming 100 percent loan repayment. A financial analysis of the sample branches (Srinivasan and Meyer) revealed that average interest spreads were of the order of 3 percent, well below the overall intermediation costs reported in Table 2. Note also that average costs are greater than marginal costs in all cases, implying that the branches are located on the downward sloping segment of a U-shaped cost curve. This result will become clearer when the scale economy measures are analyzed.

The point estimate of overall economies of scale is close to one in both models, indicating constant returns to scale. A 10 percent increase in the production of both outputs in value terms (using the accounts definition) will generate a 9.4 (9.0) percent increase in total administrative costs. As is evident from table 2, there exist substantial differences in the separate cost-effects of the expansion of individual outputs. Although there are increasing returns to both lending and deposit mobilization (rows 10 and 11), economies of scale are relatively more pronounced in the former. The partial scale economies measure of 0.28 (0.31)

indicates that a 10 percent increase in lending generates only a 2.8 (3.1) percent increase in administrative costs. On the other hand, a 10 percent increase in deposits mobilized would create a cost increase of 6.6 (5.9) percent. Thus expansion of this bank's loans is the activity that shows cost advantages as compared to deposit mobilization

There are several important qualifications to the conclusion that the branches could benefit from economies of scale by expanding their loans relatively more than their deposits. First, lending activities are defined here to include all outstanding loans. The latter contain principal amounts that have not yet been repaid and various interest amounts which have been capitalized. Second, increases in lending across the branches were not accompanied by proportional movements in deposit mobilization and branches with large loan portfolios did not carry large deposit portfolios. Further, analysis of the intra-bank flow of funds revealed that borrowing from the head office was strongly correlated with the lending activities of the branches, while deposit mobilization was highly correlated with lending to the head office. These findings imply that on the one hand, lending was expanded across branches following targeted lending programs. On the other hand, rates of interest on intra-bank borrowing and lending were set at levels that made it profitable for the branches to invest their deposits with the head office rather than to make agricultural loans.

The results appear to be consistent with the stated objectives of banking policy to increase the flow of savings intermediated in the system, and to increase the proportion of loans made to target groups, especially agriculture. Licensing policy was geared to meeting these objectives, and resulted in the proliferation of numerous, small bank branches in the rural areas after 1977 (World Bank). The results suggest that this bank's response

to licensing policy led to the exhaustion of scale economies in the average bank branch.

An important source of cost complementarities in banking is that conducting credit analyses of loan applicants who have deposit accounts is (or should be) less costly than non-depositor credit analyses. The necessary condition for cost complementarity suggested by Murray and White is met in model 1, though it is not statistically significant. This result is not unexpected since there appears to be relatively little loan screening conducted by bank branches in Bangladesh (Smith). Typically, branch officials are not originally from the areas in which they work, but are transferred every two to three years; as such, they may not be very familiar with the local villagers. During the period under review, the marketing of loans, identification of borrowers, and even loan disbursements were commonly handled by non-bank personnel (Union Credit Committees) under the government's special lending programs (which represent a significant portion of these branches portfolios). Thus there was limited use of information by different departments of the bank in extending different services to the same client.

IV. Concluding Comments

This study has estimated the costs involved in financial intermediation for a nationalized commercial bank in Bangladesh. Regulatory policy has traditionally focused on the financial costs incurred by banks. The results reported in this paper suggest that nonfinancial costs may be just as, if not more, important. Although regulation-related variables were not explicitly introduced into the cost function, the overall scale economy measure suggests that the bank's response to licensing policy resulted in

the exhaustion of scale economies of the "average" bank branch in the system. On the other hand, product-specific scale economy measures suggest possible lines for further expansion.

Financial intermediation costs incurred by the average branch appear to be large relative to the spreads authorized between interest income and interest expense. In other words, every time the branch makes a loan and opens a deposit account it is incurring a loss. Furthermore, it must be emphasized that the costs of default were not incorporated into the analysis. There is reason to believe that future loan losses incurred by the rural branches of the nationalized banks in Bangladesh may be significant (Cookson, Gregory and Adams). It is highly probable that the spreads will turn even more negative when the margins are appropriately adjusted for estimated costs of default. Therefore the bank may be justified in not adjusting to the partial scale economies that appear to exist for rural lending. If Bangladesh is to succeed in its policy of rural lending without committing scarce resources to subsidizing rural bank branches, it must simultaneously deal with two problems, namely, the minimum spread required for the bank to cover intermediation costs and how to improve the conditions for better loan recovery.

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